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INTRODUCTION

It is unlikely for employees to commit no errors. This can be ascribed to human characteristics such as opportunistic behavior and limited skills and knowledge, as well as to latent conditions within organizations (Reason, 1990). Organizations are therefore forced to deal with errors in order to reduce potentially negative outcomes. Effective error management involves minimizing the negative potential of errors (e.g. van Dyck, Frese, Baer, & Sonnentag, 2005) and deriving positive effects such as learning (Argyris, 1976, 1993; Edmondson, 1999; Festner et al., 2005; Gartmeier, Bauer, Gruber, & Heid, 2008; Nordstrom, Wendland, & Williams, 1998). The literature identifies several constituents of effective error management, including quick error detection, communication about errors, sharing of error knowledge, and quick error handling (van Dyck et al., 2005). For analytical reasons, these aspects of effective error management are often discussed separately in the literature. Nevertheless, the literature on learning from errors (Bauer, 2008: 33) and error management (van Dyck et al., 2005) indicates that successful error management should be understood as a process whose starting point is closely related to the detection of errors (Figure 3.1).

In particular, error handling, error detection, and communication about errors are regarded as the hallmarks of effective error management (van Dyck et al., 2005). Error handling is related to damage control, which directly affects profit and important mediators like reputation, while error detection and communication are closely related to organizational learning, an important mediator of firms' performance. The creation and distribution of knowledge about errors is also believed to influence a firm's performance. Van Dyck et al. (2005), for instance, found substantial correlation between effective error

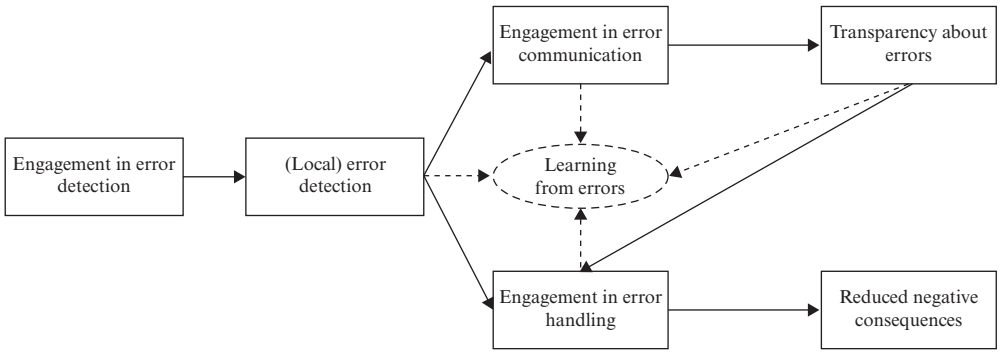

Figure 3.1 Elements of an effective error management process

management and organizational performance. Similarly, Cannon and Edmondson (2001) revealed that work groups in which errors are communicated and discussed perform better than groups in which errors lead to blaming.

However, there are several potential barriers that can impede effective error management. Limited cognitive ability, for instance, can reduce an individual's ability to identify errors correctly within complex cause-and-effect chains, even when negative outcomes indicate that an error has been made (e.g. Dörner, 1990; Dörner & Schaub, 1994). Additionally, the literature argues that employees are usually unwilling to report their own errors if this carries a higher cost—emotional as well as monetary—than not reporting them (e.g. Tynan, 2005; Zhao & Olivera, 2006). Consequently, effective error management—for instance, preventing employees from making additional errors while dealing with an existing error—is an important challenge for organizations, which requires further study.

Most error management research has focused on safety issues in the healthcare sector (e.g. Vogus, Sutcliffe, & Weick, 2010) and in so-called high-reliability organizations (HROs) such as nuclear power plants, aircraft carriers, and aviation companies (e.g. Maurino, Reason, Johnston, & Lee, 1995), since errors in these organizations can be disastrous to the physical health of their stakeholders. Managing errors effectively, however, is a task of significant importance for all organizations, since errors can also cause financial damage. Although research on error management has often focused on professional service firms (PSFs) from a physical safety point of view, research on the financial impact of error management is sparse (for an exception see van Dyck et al., 2005). Moreover, research has neglected specific characteristics of PSFs that may influence the way employees deal with errors. Such characteristics include service intangibility (Lowendahl, 1997; Lowendahl, Revang, & Fosstenlokken, 2001) and the impact of working conditions in PSFs, such as strong career orientation and fierce internal competition for limited promotion opportunities (Malhotra, Morris, & Smets, 2010). This chapter addresses these research gaps by analyzing the error management problems of PSFs as well as possible ways to overcome them. For this purpose, we present a review of the literature on human error and error management.

WHAT IS AN ERROR?

Although the concept of error is frequently used in the literature, an agreed definition is lacking. A definition, however, is important to specify the object of investigation. Our definition is based on the criteria most frequently mentioned in the error literature. Using the most commonly mentioned characteristics, the concept of error can be defined as (1) an action in the context of work, (2) which could have been avoided (Brodbeck, Zapf, Prümper, & Frese, 1993; Norman, 1981; Reason, 1990; Zhao & Olivera, 2006), (3) and which would be "judged as a deficient deviation from an expected standard" (4) "by knowledgeable and central members of a given occupation, organization, or local community of practice" (5) "at a given point of time" (Bauer & Mulder, 2008: 117) and (6) which "may lead to actual or potentially negative consequences for organizational functioning" (Zhao & Olivera, 2006).

Errors are commonly distinguished from violations (Kriegesmann, Kley, & Schwering,

2005; Reason, 1990; Zhao & Olivera, 2006). Often, the distinction between these two concepts is rooted in the argumentation of cognitive psychology (Reason, 1990). Psychologically orientated research on human dealings with error often defines the concept of error using different error taxonomies according to the level of cognitive regulation of the acting individual (van Dyck et al., 2005; Rasmussen, 1987; Reason, 1990; Zhao & Olivera, 2006). Thus slips (a person intended to act in a certain way, but the real action did not proceed according to the planned action) are distinguished from rule-based and knowledge-based errors (unintended performance gaps where the action did proceed as planned). Since this approach is based on the cognitive regulation of the acting individual, it is linked to their intentions or goals. Thus, this approach does not consider successful violations to be errors, because they proceed as planned and reach their intended goal (Zhao & Olivera, 2006). However, in organizational literature, some authors classify violations as a subcategory of errors (e.g. Kriegesmann et al., 2005: 59), because both are deviations from expected standards which could damage the organization. Accordingly, organizations may feel compelled to punish unintended errors (Hendry, 2002) as well as violations (Kriegesmann et al., 2005). Violations are narrowed down to those undesirable actions that are based on a decision intentionally to break a rule—for example, opportunistic behavior or deliberate risk taking. Hence, for analytical reasons, violations may be distinguished from actions that are based on a combination of well-meant intentions and lack of knowledge—for example, honest incompetence (Hendry, 2002) and knowledge-based errors (Reason, 1990). In reality, however, organizations may not identify the intentions of their employees, thereby failing to distinguish unintended errors from violations. This could enable employees to make violations appear as honest incompetence, for example by lying about their true reasons.

Furthermore, some authors distinguish errors from actions that are suboptimal (Zhao & Olivera, 2006), whereas others suggest that inefficient actions should be classified as errors (van Dyck et al., 2005). While errors are regarded as actions that do not achieve the intended goal, inefficient behaviors lead to the final goal via a detour. Within the context of work, however, it has been argued that inefficient actions are erroneous, because people should constantly aim to work efficiently (Zapf, Frese, & Brodbeck, 1999: 399). From this point of view, inefficient action should be classified as a deviation from an expected standard. Besides, both employee errors and inefficient action put organizations at financial risk. Furthermore, both may sometimes have similar origins, such as a lack of knowledge of how to perform better. Accordingly, empirical research has revealed that "managers sometimes report inefficiencies as examples of errors" (van Dyck et al., 2005: 1229). Hence, one might assume that, in many cases, inefficient employee behavior would be subject to the same sanctions as errors. Owing to the difficulty researchers and practitioners have in distinguishing errors from inefficiencies, inefficient action is understood to be an error.

INTERACTION BETWEEN LATENT CONDITIONS AND BARRIERS TO EFFECTIVE ERROR MANAGEMENT

Research on human error aims to reveal the antecedents that lead to undesired outcomes, such as failures within process, organizational breakdowns, and inappropriate task

fulfillment. As indicated above, error management is seen as an important and complex process that is often inappropriately fulfilled within organizations (van Dyck et al., 2005; Tucker & Edmondson, 2003). In order to provide recommendations to improve error management, researchers need to understand why the error management process often fails within organizations. To put it another way, it has to be understood why employees commit additional errors while dealing with previous errors. Since research on human error has highlighted several factors that are likely to promote the failure of complex processes, it appears worthwhile to apply knowledge about the origins of human error to situations where people are required to deal effectively with human error. This section aims to analyze how research on human error might explain inappropriate error management.

In the literature, it has been frequently argued that undesired outcomes (e.g. an airplane crash or the financial failure of an innovative project) often result from a combination of active failures and latent conditions (e.g. Reason, 1990, 2000; Sasou & Reason, 1999), also known as latent failures (Reason, 1990). So far, however, the literature lacks an analysis of how these insights relate to situations where organizations are challenged to deal effectively with errors. Active failures are erroneous actions "committed by people who are in direct contact with the patient or system" (Reason, 2000: 769); latent conditions are defined as "the inevitable 'resident pathogens' within the system [that] . . . arise from decisions made by designers, builders, procedure writers, and top level management" (Reason, 2000: 769). While active failures are located at the individual level, latent conditions describe organizational characteristics that promote the committing of errors. Reason (1990) makes a distinction between active failures and latent conditions when analyzing cause-and-effect chains that have led to catastrophes. The Chernobyl disaster, for instance, was the result of active failures (e.g. employees disconnected the emergency core cooling system from the primary circuit) and latent conditions (e.g. employees were advised to perform this procedure as part of the test plan, even though it compromised the power plant's safety systems) (Reason, 1990: 255).

It appears worthwhile to apply this distinction in order to understand why the error management process often fails. With regard to error management processes, latent conditions can be understood as an organizational context that increases the amount of additional errors made by employees while managing other errors. For instance, it might be classified as active failure if employees fail to detect their own errors, for example if a cook fails to notice that he had used salt instead of sugar, whereas it might be classified as a latent condition if the organization fails to enable employees to detect their own errors—for example if a cook is not allowed to talk to the diners or a development team is not given enough time to test their inventions. Hence, barriers to effective error management are closely interrelated with latent conditions. We start by discussing the elements of latent conditions before providing insights into the interactions between latent conditions and the barriers they present to effective error management.

Elements of Latent Conditions Supporting Process Failure

The literature has identified several dimensions by which latent conditions promote errors in task fulfillment, such as (1) the scope of human or technical action required, (2) the challenge it presents to employees, (3) their abilities, and (4) their motivation. In the

following section, insights about the elements of latent conditions are discussed in relation to the following dimensions.

First, latent conditions influence the scope of human action necessary to fulfill a task. Considering that errors are defined as specific human actions, the installation of technical systems (e.g. computers) into a work flow reduces the necessity for human action and thus the possibility of human error. Therefore, transferring tasks from employees to technical systems diminishes skill limitations and opportunistic behavior as potential sources of human error. A computer-based spell checker, for instance, might improve a firm's management of employees' spelling mistakes.

Second, latent conditions influence the challenges an employee faces while trying to fulfill a task (Reason, 1998). In order to capture the factors that influence the occurrence of errors, Sasou and Reason (1999) introduce the concept of performance-shaping factors, which may be external (e.g. darkness, high work requirements), internal (e.g. fatigue, deficiencies in knowledge) or team-based (e.g. lack of communication, inappropriate task allocation). These factors are important elements of latent conditions, because they influence the scope of the challenge in fulfilling a task. The challenge of fulfilling a task becomes proportionally more complex under latent conditions, where the rules of correct action are unknown, unspecified, or inconsistent with other rules. Under such conditions, employees face the challenge of selecting the action most likely to be appropriate. Such situations may be characteristic of many PSFs whose core business involves inventing new and unique solutions (e.g. top management consulting, advertising).

Third, latent conditions influence employee abilities. For example, an organization's approach to employee selection, promotion, and coaching must be regarded as part of the organization's latent conditions that affect employee skills (Reason, 1998). Several studies have revealed that effective training helps to improve employee ability and reduce the tendency to make errors (Keith & Frese, 2008). In addition to training, organizations also have the option of replacing employees with others who are less likely to commit errors.

Fourth, latent conditions also influence the extent to which employees are motivated to accomplish a task for the benefit of their organization. Incentive schemes are an important element of latent conditions, and several theories assume that incentive schemes govern employee behavior. However, the literature indicates that employee characteristics may be heterogeneous and that not all employees are influenced in the same way by a specific incentive scheme (Davis, Schoorman, & Donaldson, 1997). Social and financial incentives, for example, have been identified as a major factor in shaping employee behavior (Lubatkin, Lane, Collin, & Very, 2007; Zahra, 2007). Theories such as the principal–agent theory assume that employees seek to maximize their utility and adapt their behavior on such considerations (Eisenhardt, 1989). So called "agents" are supposed to betray the organization intentionally if this behavior is likely to increase their individual benefits. In contrast, some organizational theorists argue that employee behavior may be influenced by their intrinsic motivation rather than external incentive systems (Davis et al., 1997). So-called "stewards" are supposed to reach self-fulfillment by aligning their behavior to the goals of the organization. Because of their intrinsic motivation, stewards are also likely to behave to the benefit of the organization even if their behavior is not financially rewarded.

Research on human error has revealed that lack of motivation has a significant

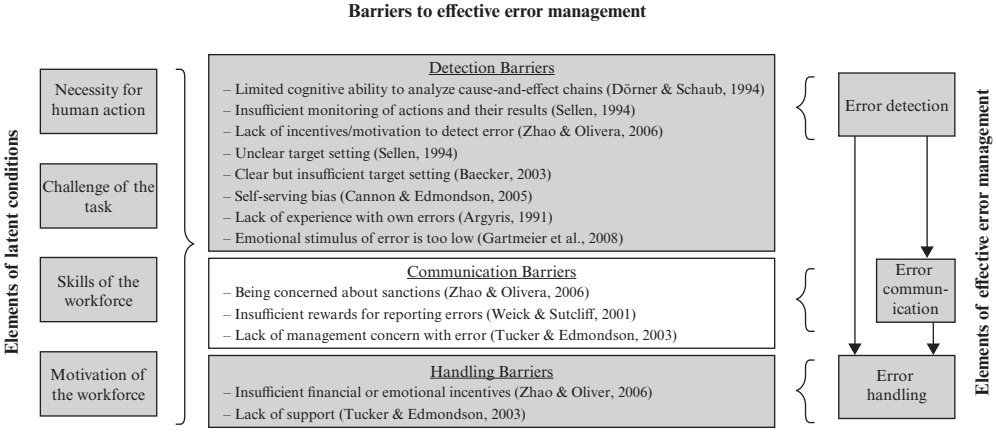

Figure 3.2 Barriers to effective error management

influence on employee error; Reason (1990) found that in many cases system failures were induced not by lack of employee skills but rather by lack of willingness to fulfill a task according to well-known rules. Monitoring systems, which also form part of the latent conditions, are regarded as an appropriate instrument to supplement organizational incentive schemes, since they reduce the room for employees to act against the organization's interests (Eisenhardt, 1989; Lubatkin et al., 2007).

Barriers to Effective Error Management

Several factors and mechanisms have been identified that potentially impede or promote elements of effective error management. The findings of the literature are presented below according to their impact on the three hallmarks of error management: detection, communication, and handling of errors (Figure 3.2).

Barriers to error detection

The detection of errors is considered an element of error management because it is the starting point for individual and organizational learning (Bauer & Mulder, 2008), as well as being necessary for engaging in error handling (van Dyck et al., 2005). Hence, enabling organizations to detect errors requires either the installation of technical systems or the enabling and motivation of employees to overcome detection problems. Research has enumerated several modes of error detection (Sellen, 1994): (1) action-based detection, (2) outcome-based detection, and (3) detection through limiting functions.

Action-based detection is defined as "catching an error on the basis of perception of some aspect of the erroneous action itself" (Sellen, 1994: 481). This requires that the "correctness" of an action can be clearly evaluated. Barriers to action-based error detection occur if deviations from the intended action cannot be sufficiently monitored (Sellen, 1994: 481). Furthermore, action-based error detection might be impeded in situations where actions follow a rule that is in conflict with the mission of the organization at a higher level (Baecker, 2003).

Outcome-based detection focuses on the product or consequences of an action. Outcome-based detection requires the existence of a desired outcome that is measurable. Outcome-based detection is hindered by ill-specified outcomes, problems in perceiving the outcome and failure to identify cause–effect relationships (Sellen, 1994: 481). Dörner and Schaub (1994), for example, reveal that individuals are widely unable to identify the cause-and-effect chains in dynamic decision making, even if the outcomes are observable. The authors stress several factors that increase the likelihood that errors will not be correctly identified, including the number of variables that can be influenced by the person, the degree of interdependence of variables, the time lag between input and reaction of the variables, the time pressure on the person acting, and the time lag before receiving feedback on the result of the actions.

Cannon and Edmondson (2005) observed that humans have a tendency to ignore their own errors. They argue that this is not necessarily caused by fear of punishment or debasement, but by psychological factors such as the maintenance of self-esteem. Furthermore, it has been argued that a lack of negative emotions is—at least on occasions—likely to decrease the chance of action-based and outcome-based error detection, because a painful stimulus may increase employee awareness of the need for improvement (Gartmeier et al., 2008). Another factor that supposedly hinders employees from correctly attributing failure to themselves is a lack of experience with their own errors, due to a lack of opportunity to experience their own fallibility (Argyris, 1991: 103f.).

Detection through limiting functions implies that errors are detected "because constraints in the external world prevent further action" (Sellen, 1994: 481). For instance, those who reach the end of a blind alley before reaching their final destination are more likely to realize that they have taken a wrong turn. Similarly to the outcome-based detection mode, error detection through limiting functions challenges employees to attribute the causes of the undesired outcomes and thus analyze the cause-and-effect chains. As stated above, several barriers hinder the employee's ability to cope with these challenges.

Barriers to error communication

A lack of communication can cause information asymmetries about specific errors if other employees do not detect the very same error. Thus, detection and communication are functionally interrelated, because repeated detection of the same error by different employees can compensate for a lack of communication.

In situations where individuals have an information asymmetry about errors and assume that these errors cannot be detected by anyone else, they may display a variety of reporting and non-reporting behaviors (Zhao & Olivera, 2006). Individuals may report errors as they are, rationalize their reporting, or blame someone else. Non-reporting can be differentiated into covering up errors, handling them on one's own, and ignoring them (Zhao & Olivera, 2006). Zhao and Olivera further argue that employee behavior decisions are based on cost–benefit considerations. Employees supposedly take into account the costs (e.g. material costs, damage to personal image, reputation costs) and the benefits of reporting (e.g. self-concept benefits, learning benefits). They are unlikely to report errors if costs are high and benefits low. For instance, if employees who commit an error are punished by the organization (e.g. their career chances are reduced or they have to leave the company), employees have no incentive to report their errors, according to agency theory. Therefore, they are likely to try to conceal their errors to avoid punishment

(Tynan, 2005). Edmondson (2004) provides evidence for this rationale; she reveals that teams with higher levels of psychological safety, that is, the belief that the team is safe for personal risk taking (Edmondson, 1999), report more errors than teams with lower levels. Rybowiak, Garst, Frese, and Batinic (1999) show that high job uncertainty and career stress are positively correlated with the covering up of errors. The authors argue that employees tend to cover up errors if their communications are punished and their careers jeopardized. Tynan (2005) indicates that individual employees and work groups are unlikely to seek support while trying to cope with a self-inflicted problem if this specific form of communication is expected to get them into trouble. Failing to seek support, however, may reduce the chance of handling errors effectively.

Barriers to error handling

In a survey on problem handling by nurses, Tucker and Edmondson (2003) identify a dynamic relationship among different barriers to successful task accomplishment. They developed a model that considers the factors that negatively influence the overcoming of barriers to complete a work task. They argue that employee work flows are often disrupted as problems occur that have to be dealt with, for example if a construction worker is missing the optimal tool to fulfill a certain task. Problems are promoted by latent conditions and by barriers to task completion. According to the authors, employees may address problems through both first-order and second-order problem solving. First-order problem solving refers to behavior where a problem is overcome by obtaining the required resources to resolve the specific situation, whereas second-order problem solving addresses the latent causes that promoted the problem. Since problems are rooted in latent conditions, only the latter reduces the likelihood that a similar problem will recur. Tucker and Edmondson (2003) further reveal that successful first-order problem solving negatively influences employee efforts to engage in second-order problem solving. If employees successfully handle problems by themselves, they are unlikely to see a need to communicate their knowledge of latent conditions to upper levels of the organization. Overall, their model indicates how valuable individual learning might prevent even more valuable organizational learning. However, successful error handling as a barrier to error communication does not necessarily imply the opportunistic intent of an employee. Although quick error handling may be caused by an employee trying to cover up an error, it may also be caused by a well-meaning employee taking responsibility for correcting the error without involving or disturbing others (Zhao & Olivera, 2006: 1024).

However, the literature has also identified barriers to error handling at the individual level. First, employees sometimes lack the motivation to handle errors, particularly if they believe that handling them will cause them more trouble than benefit (Zhao & Olivera, 2006). For instance, if the handling of an error is not acknowledged by other members of the organization, employees lack the incentive to invest in error handling. Additional barriers to error handling are lack of ability (Zhao & Olivera, 2006) and lack of support from others (Tucker & Edmondson, 2003).

Mechanisms of Latent Conditions Related to (In)effective Error Management

Table 3.1 summarizes the multifarious impact of latent conditions on the elements of error management.

Table 3.1 Mechanisms related to (in)effective error management

		Elements of error management		
		Detection	Communication	Handling
Management	Necessity for human action	• Monitoring (e.g. social or technical monitoring) reduces the need for employees to detect (own) errors.	• Monitoring can compensate for lack of communication.	• Technical systems reduce need to handle (own) errors. • Intervention/support of others reduces the need for employees to handle (own) errors.
	Challenge of a task	• Opportunities to observe actions increase action-based error detection. • Decreasing specification of desired actions reduces action-based error detection. • Outcome-based error detection requires opportunity to observe the results of an action. • Increasing complexity of the cause-and-effect chain of action reduces outcome-based error detection. • Increasing support by others promotes error detection. • Decreasing time to engage in reflection increases the challenge of error detection.	• Easy access to the addressee of the information decreases the challenge of communication, e.g. if a subordinate is welcome to speak directly to top management about latent conditions. • Challenge of communication increases if others in the official chain of communication seek to interrupt the communication flow, e.g. if the supervisor of a subordinate aims to prevent the subordinate pointing out poor supervision to top management.	• Increasing support by others promotes error handling. • Specifications about how to handle errors correctly decrease the challenge of effective error handling.

Employee skills	• Experience in error detection promotes detection skills and ability to anticipate errors.	• (Mental) skills for sharing own knowledge are assumed to be rather low.	• Experience in successfully solving similar errors promotes error handling skills.
Employee motivation	• Rewards for communicating/handling errors increase motivation to engage in error detection. • Punishment for not communicating/handling own errors increases motivation to engage in detection of own errors. • Punishment for not communicating/handling errors of others increases motivation to engage in detection of errors of others. • Room for opportunistic behavior is closely related to monitoring systems.	• Punishment for communication about own errors decreases willingness to communicate about own errors. • Punishment for not communicating about own errors increases willingness to communicate about own errors. • Rewards for communication about own errors increase willingness to communicate about own errors. • Rewards for communication about errors of others increase willingness to communicate about errors of others. • Success in first-order problem solving decreases motivation to communicate about latent conditions. • Room for opportunistic behavior is closely related to monitoring systems.	• Incentives for error handling have similar effects to incentives for communication about errors (compare middle column of this row).

On the one hand, this framework appears to point the way to success by combining insights about effective error management from the literature, as many studies address only limited areas of effective error management rather than drawing a holistic picture of the interrelations among each fragment (as an exception see Tucker & Edmondson, 2003). On the other hand, as highlighted in the sections that follow, it is ineffective to focus on isolated mechanisms and ignore their interactions. If these interactions are neglected, contradictions may be overlooked and, consequently, the recommendations for improving error management may be insufficient, if improving a specific error management mechanism causes greater disruption to another. Therefore, the literature suggests a need for more emphasis on the interactions among mechanisms of effective error management (van Dyck et al., 2005: 1237).

IDENTIFICATION AND DISCUSSION OF THE LITERATURE'S IMPLICATIONS FOR ERROR MANAGEMENT

A review of the literature reveals three frequent recommendations for improving organizational error management: (1) introducing safe environments, (2) providing incentives and rewards, and (3) introducing teamwork and team training. Although these are interrelated, we will discuss the effects of each of these on an organization under separate headings.

Safe Environments

Based on the finding that fear of punishment discourages employees from communicating honestly about errors, researchers frequently recommend introducing an environment that allows employees to talk about their errors without fear of punishment (Bauer, 2008; Edmondson, 1999; Tynan, 2005; Weick & Sutcliffe, 2001). The literature introduces several approaches to promote employee willingness to talk about errors. First, organizations should provide their employees with psychological safety to overcome communication barriers. Second, some authors suggest that organizations provide employees with some kind of immunity against punishment. Third, evidence suggests that safe communication channels might increase employee communication about errors.

First, introducing psychological safety increases employee willingness to report errors. According to Edmondson (1999) and Tynan (2005), psychological safety is based on mutual respect among employees and characterized by a shared belief that they will not be rejected, embarrassed, or punished by colleagues for speaking up. Such working conditions are closely related to proactive feedback-seeking that promotes learning, because employees are more likely to engage in social learning by sharing knowledge about their own errors with colleagues if they do not fear social punishment for revealing their errors (Bauer, 2008; Zhao & Olivera, 2006). Despite its implications, however, the research rarely addresses how the pressures on employees who seek job promotion might limit the organization's ability to promote psychological safety. Presumably, competition among employees for limited chances of promotion would decrease their willingness to speak up among colleagues about their own errors, because they may wish to create

the impression that they deserve promotion. Furthermore, exactly how management should behave to create such psychological safety remains unclear. For instance, Tucker and Edmondson (2003: 67) argue that "creating a psychologically safe work environment does not require managers [to] be excessively warm and friendly, but instead that they invite others to express their concerns and model fallibility by admitting their own errors." Implementing this may prove problematic, however, because it remains unspecified how and why such an invitation should translate into mutual respect and trust. Furthermore, this recommendation may be tautological for organizations not managed by their shareholders, since psychological safety is a precondition for psychological safety. Managers are supposed to create psychological safety by reporting honestly about their own errors. However, it has been argued that employees (including managers) are unlikely to report their own errors in an atmosphere that lacks psychological safety (Edmondson, 1999; Tynan, 2005). Instead, psychological safety is regarded as an important factor that promotes a willingness to report one's errors honestly. From a theoretical point of view, it appears questionable, if and under which conditions the development of psychological safety may be described by the concept of a misleading Nash equilibrium, where all employees (managers included) are motivated to protect their reputation instead of investing in psychological safety. From a practical point of view, we assume that managers face many conflicts in promoting psychological safety "by admitting their own errors" if they are held accountable either by a supervisor or by the company's owners and if they have to promote themselves to them as their best choice.

Second, some authors recommend that organizations provide their employees with special immunity to increase communication about errors. Van Dyck et al. (2005: 1230), for example, suggest withholding punishment for communicating errors. Still, the implications of withholding punishment are problematic for a number of reasons. More information is needed on how organizations could avoid all forms of social sanction against employees. Furthermore, it remains unclear whether this includes direct punishment for the error being reported (e.g. by immediately penalizing the employee) as well as indirect punishment (e.g. reducing the employee's chances of promotion, or changing work conditions to the detriment of the employee who reported it). In either case, it is not specified under what conditions such a non-punishment culture might conflict with working conditions where employees compete with each other for reputation and/or promotion, as in many PSFs such as management consultancies or law firms. Furthermore, it remains unclear if and how organizations would protect themselves from exploitation by low-performing employees within such an atmosphere of immunity. Regarding the last issue, there are concerns that this approach may have negative side effects. The concept of non-punishment is regarded as an instrument to overcome barriers to employee communication about their own errors (van Dyck et al., 2005; Weick & Sutcliffe, 2001). The implicit assumption is that employee behavior is related to a cost–benefit analysis, such that employees will disclose their own errors to the detriment of the organization if they benefit from such opportunistic behavior. Such situations and behavior are discussed by agency theory. Agency theory, however, discourages organizations from implementing a non-punishment culture, because certain employees may try to exploit the organization if they are not punished for misbehavior. Instead, agency theory advises organizations to apply governance mechanisms such as

monitoring and incentive systems, since a non-punishment atmosphere would alter the distribution of risk. Employees would be relieved of personal risk even if they engaged in actions risky to the organization and relatively low in expected return on investment. If success is then rewarded, employees might escalate their engagement in such risky actions. From the employee's perspective, this risk asymmetry can be characterized as "I win, the organization loses." This argument is supported by Kriegesmann, Kerka, and Kley (2006), who reveal that, within organizational environments where the failure of innovative projects is not strictly punished, employees increase their engagement in risky exploration. They reveal that this organizational environment produces mixed benefits. On the one hand it is likely to promote innovation, while on the other it is likely to reduce the relative success rate of innovation and thus increase the average cost of innovation, because anticipation of punishment for a failed venture tends to make the prospect of expensive experimentation unappealing. This observation parallels the findings of Lee, Edmondson, Thomke, and Worline (2004: 312), who argue that "[r]ewards [!] systems that punish failures increase the costs of experimentation [for employees], and may make individuals reluctant to experiment" (see also Baecker, 2003; Cannon & Edmondson, 2005). In addition, establishing a non-punishment culture has limited value if it is virtually impossible to distinguish unintended errors from deliberate violations. A non-punishment atmosphere would then open the floodgates for employees to engage in opportunistic behavior. Furthermore, there is doubt about the compatibility of this implication with internal career competition or job uncertainty. It would push career models to absurdity if errors committed by employees were not directly or indirectly considered when evaluating their performance and skills. Errors might, for example, throw light on an employee's lack of skills or motivation, which may not have been observed by the organization so far (e.g. hidden characteristics or hidden intentions). These concerns are in accord with Reason (1998: 303), who argues that a "culture in which all acts are immune from punishment would lack credibility in the eyes of the workforce." Hence, concepts that aim to inhibit indirect punishment for errors appear utopian.

Third, in order to enhance employee communication about errors, different practices have been implemented to create a safe communication channel. Organizations such as hospitals (Weinberg, 2002), pharmacies (Kanse, van der Schaaf, Vrijland, & van Mierlo, 2006), and aviation companies (Green, 1990) have established anonymous and non-anonymous reporting systems to allow employees to report errors without fear of punishment. Several studies provide evidence that the installation of safe communication channels encourages employees to communicate openly about their errors. Sucov et al. (2001) reveal that the additional application of an anonymous error reporting system in a medical institution significantly improves error detection compared to traditional incident reporting systems. Green (1990) describes the establishment of an independent organization in the aviation industry. This organization allows pilots to report their errors in complete confidence, although not anonymously. The external organization analyzes how these errors can be avoided in the future without short-dated replacement of the employee who committed the error. These safe communication channels, however, do not directly address the problem of employee detection of their own errors in the first place. Nevertheless, employees may sometimes detect their own errors later if they are given information about their own (mis)behavior by a whistleblower. The "detour" of

such feedback might remove the conflict for employees who fear that giving critical feedback directly to their boss might cause anger and thus provoke direct or indirect sanctions. Since these forms of safe environment are based on anonymity, they require a minimum number of employees to be applicable.

Incentive and Reward Systems

Some analyses of organizational error handling recommend that organizations revise their incentive systems. As stated in the previous section, agency theory argues that incentive systems have the potential to motivate employees extrinsically to align their behavior with organizational goals. Following the agency theory argument, incentive systems can motivate employees to engage in detection, communication, and handling of errors. Hence, van Dyck et al. (2005: 1230) and Weick and Sutcliffe (2001: 58) recommend that organizations reward communication about errors in order to motivate employees to report their own and colleagues' errors. Weick and Sutcliffe (2001: 58) recommend rewarding communication about one's own errors—even in cases where the error has severely cost the organization. We wonder, however, whether employees should be rewarded again and again for reporting their errors if they commit more errors than their colleagues. We argue that such reward systems are likely to distort career systems to the point of absurdity.

Agency theory argues that employees are likely to strive either to receive an incentive or to avoid punishment. From this perspective, the combination of (1) a career-orientated HRM system that aims to reward behavior aligned to the organization's goals with (2) a feedback culture is likely to promote employee efforts to engage in key aspects of effective error management. If employees are rewarded for reporting the errors of others, they are likely to increase their efforts to detect such errors. Thus a social monitoring or "error witch hunt" system is created. As a consequence, it becomes more difficult and risky for employees to cover up their own errors, since they have to fear detection by a colleague. Hence, employees are forced to increase attempts to handle their own errors quickly. Furthermore, the combined conditions of social monitoring and sanctions against hiding their own errors put pressure on employees "voluntarily" to disclose their own errors that are likely to be detected by someone else. However, this argument is a set of hypotheses based on the tenets of agency theory, and it needs empirical analysis. Nevertheless, Rybowiak at al. (1999: 534) found a strong correlation between "error competence and learning from errors" and "need for achievement." Furthermore, Stock, McFadden, and Gowen's (2007) study provides evidence that hospitals with a control orientation provide better patient safety than their competitors.

Teamwork and Team Training

Teams and team training are further recommendations for organizations to prevent errors and improve error management. These approaches are especially recommended in the aviation and healthcare industries, and their effects have been tested by researchers (Alonso et al., 2006; Barach, 2007; Salas, Burke, Bowers, & Wilson, 2001). Burke, Wilson, and Salas (2005) believe that teams are one of the most important mechanisms for reducing errors within HROs, and consider their introduction a prerequisite for

organizations to develop into HROs. On the one hand, teams have a monitoring function, since the behavior and work of team members are constantly monitored by other members of the team. However, when the team faces joint responsibility, this monitoring function may displace the boundaries of communication from the individual to the team level, rather than entirely overcoming them. On the other hand, teams also provide a back-up function, since the occurrence of errors can be reduced by double checking. Teams, however, have to be constantly trained if they are to improve an organization's error management. Cook, Hoas, Guttmannova, and Joyner (2004), for instance, recommend interdisciplinary training of healthcare teams to improve the ability of all team members to identify medical errors. Industries such as aviation and healthcare try to increase the positive effects of teamwork by introducing training programs to prepare teams to handle errors effectively and increase customer safety (Barach, 2007).

Nevertheless, Sasou and Reason's (1999) investigation of the performance-shaping factors within teams reveals that teams cannot be considered a panacea per se, because several factors, such as lack of communication, inappropriate task allocation and overtrusting, are likely to promote errors within work groups. In a review of the literature on crew resource management in the aviation industry, Salas et al. (2001) showed that team building and crew resource management may enhance learning but not necessarily reduce errors.

CHALLENGES RELATED TO MANAGING ERRORS IN PSFs

Most research on how organizations deal with errors does not take into account the specific characteristics of profit-orientated PSFs, whereas hardly any research on for-profit PSFs focuses on error management. In order to understand how PSFs deal with errors, we have to transfer our knowledge about organizational error handling to the specific context of PSFs.

Because of the characteristics of PSFs, such as the intangibility of the product (Lowendahl, 1997; Lowendahl et al., 2001), a special set of latent conditions is present that differs from those of other organizations. In the following section we outline the special challenges PSFs face in managing errors effectively. These originate from the difficulty of evaluating professional services. We will concentrate our discussion on the context of PSFs that have no protected designation, because PSFs such as management consulting are supposed to face even greater challenges in bridging client uncertainties that might impede engagement in a business relationship. While the professional system can, to a degree, bridge client uncertainties for PSFs like auditing or law firms, there is little professional trust for management consultancies (Glückler & Armbrüster, 2003). Hence, these companies rely to a large extent on client trust in the consultancy itself. This implies that a consultancy's reputation may be an extremely important intangible asset, which is supported by its importance in the purchasing of consultancies (see e.g. Clark, 1993; Dawes, Dowling, & Patterson, 1992). Because errors are likely seriously to damage reputations, effective error management can be regarded as essential to protect a consultancy's reputation.

Problems with Error Detection in PSFs

Research has shown that professional services firms often operate under conditions of uncertainty and ambiguity (Alvesson, 1993, 2001). Hence, professionals such as consultants face a lack of rules about how to act correctly (Mohe & Stollfuß, 2009). These findings align with the literature's insights that management consulting lacks a defined base of knowledge that is adequate to overcome consultants' struggle with ambiguity (Glückler & Armbrüster, 2003). Thus, the range of actions that cannot be classified *ex ante* as right or wrong is relatively wide. Accordingly, many actions cannot be aligned to predefined patterns of behavior. Even though higher-level goals may be familiar (e.g. curing a patient, improving the client's organizational strategy, increasing company profitability), employees often have to decide ad hoc which action is most likely to reach these goals. If employees face a lack of knowledge about the cause-and-effect chains of these ad hoc actions, possibilities for action-based error detection are considerably constrained. Furthermore, objective evaluation of the effects of professional services like business consulting is limited by the nature of the service. Characteristics such as ambiguity (Alvesson, 1993, 2001), immateriality, social interaction, and complex and partially invisible side effects (Clark, 1995; Clark & Salaman, 1998; Ernst & Kieser, 2002) impede the objective evaluation of a professional's work, because these characteristics minimize employees' possibilities of understanding all cause-and-effect chains that are relevant for engaging in valid outcome-based error detection. These difficulties in detecting errors may make it easier for employees to shield their errors from detection by others. Especially within PSFs such as business consultancies, it seems almost impossible to evaluate actions without knowing their specific context. However, knowing the context of the professional service may require observation of the interactions between service provider and service consumer. Thus, employees of professional services possess a degree of discretion which provides an opportunity to hide their errors.

Mechanisms Relating to Error Communication and Handling in PSFs

We argue that many employees in PSFs operate under conditions that tend to promote their willingness to engage in internal impression management. PSFs like top management consultancies, law firms, and auditing firms are thought to apply rigid human resource management systems whereby employees are regularly either promoted upwards or laid off (Greenwood & Empson, 2003). This system is supposed to create "little socially acknowledged space for people to rationalize failures" (Alvesson & Kärreman, 2007: 721). Alvesson and Kärreman (2004) provide evidence that, under these working conditions, employee loyalty when dealing with errors in trade-off situations lies with the team rather than the organization. Based on the rationale of Zhao and Olivera (2006), we can argue that the cost of error communication is high in PSFs with rigid HRM systems, since reporting one's own errors might reduce one's chance of promotion. Therefore, the likelihood of reporting errors is reduced. Accordingly, Nippa and Ehrhardt (2003: C5) argue that rigid HRM practices within consultancies might "lead to inferior returns as a rat-race for limited top ranks is likely to occur." Similarly, Pfeffer (2001) argues that fighting the war for talent is hazardous to an organization's health, because a war for talent might induce a detrimental war among talented employees. Such a war, however, might be an

incentive for employees to handle their own errors quickly and monitor their colleagues. Handling their own errors quickly reduces the chance of being detected and exposed by colleagues, while monitoring colleagues increases the likelihood of detecting their errors and so reducing their chance of being promoted. Besides this kind of social monitoring, formalized monitoring systems are also supposed to counteract employee tendencies to withhold knowledge about errors.

Research reveals that many PSFs apply a variety of monitoring systems. Alvesson and Kärreman (2004: 431) observed a fairly strictly formalized feedback culture among employees and projects in a consultancy. Employees were evaluated at regular intervals by their managers regarding their personal development and overall performance. Several standardized evaluation practices, such as apprenticeship (Greenwood & Empson, 2003: 918), standardized software, and policy documents (Alvesson & Kärreman, 2004: 431), were applied to achieve (and/or signal) a fair and unbiased evaluation process. However, the limitations of the monitoring systems were closely related to the considerable problem of evaluating professional services, which leaves room for internal impression management. Hence, Alvesson and Kärreman (2007) raise doubts about the validity of the evaluation system. Furthermore, Schoeneborn (2008) indicates that consultants utilized the ambiguity of their company's PowerPoint-based knowledge management system for internal impression management. He reveals that the knowledge management system of this company impeded the potential to learn from the errors of other project teams, owing to the ambiguity of the PowerPoint presentations. Frequently, these PowerPoint presentations were the only source of information about past project processes for other employees. However, Schoeneborn's investigation indicates that these presentations were exploited by employees to present a consistent and rational project process to their colleagues. Potential ambiguities, doubts, errors, or diversions inherent in the project process were not reported in the PowerPoint presentations (Schoeneborn, 2008: 172). Thus, the PowerPoint presentations can be regarded as a whitewashed version of the projects. Likewise, Alvesson and Kärreman (2004) observed tendencies among consultants to whitewash their performance. Consultants were observed not to reveal their overtime to the project controller in order to increase their recorded ratio of output to hours worked (Alvesson & Kärreman, 2004). Whereas the first kind of impression management reduces organizational learning, the second promotes the misallocation of human resources.

Argyris (1991) observed that consultants dealt defensively with their own errors. Consultants "projected the blame for any problems away from themselves and onto what they said were unclear goals, insensitive and unfair leaders, and stupid clients" (Argyris, 1991: 101). Hence, Argyris (1991) and Ernst (2002) reveal that consultants tend to attribute the cause of undesired outcomes to others. Although these consultants were considered to deal defensively with their own errors, "they presented themselves as champions of learning" (Argyris, 1991: 105). On the one hand, these observations can be interpreted as an indicator that consultants face major problems in correctly detecting and evaluating their errors. On the other hand, they could also indicate that consultants tend to engage in impression management when evaluating their errors. According to Argyris (1991: 104), consultants deal defensively with errors to protect themselves from guilt for being overly paid for a service that had room for improvement.

Overall, it has been estimated that the HRM systems in top management consultancies

create a curious situation: On the one hand, they are said to "motivate professionals . . . to work excessively hard" (Greenwood & Empson, 2003), attract high performers by giving them recognition, support skills development among high performers (Alvesson & Kärreman, 2007), and enhance the consultancy's reputation by signaling to clients that they have high-performance personnel (Armbrüster, 2004). On the other hand, we argue that the internal tournament situation is likely to promote a selection process that tends to crowd out intrinsic honesty about employees' own errors in the company.

The Limited Applicability of the Literature's Error Management Advice

Owing to the special latent conditions within PSFs, the suitability of the recommendations in the literature to improve error management is limited. Because of the lack of empirical research, the following section has to be seen as a theoretical discussion rather than empirically proven knowledge.

The introduction of a broad non-punishment environment is probably doomed to fail because of insurmountable conflicts with PSFs' career systems. The implementation of anonymous communication channels, however, seems possible for large PSFs. Assuming competition among employees does not necessarily prevent mutual respect; cultivating respect among employees is likely to promote open communication about errors. However, future research needs to explore which instruments are likely to promote internal respect.

As highlighted in our discussion on the literature's implications for reward systems, organizations face many trade-offs, because increasing one factor to promote a particular aspect of error management (e.g. increasing employees' willingness to handle their own errors quickly) often increases other factors that hinder error management (e.g. decreasing willingness to report their errors). Furthermore, the estimated effects of reward systems diverge considerably according to which theory of employee motivation is applied. However, in either case, social monitoring is regarded as an effective instrument to improve error management. PSFs have several options to bridge the technical problems of making employees monitor each other, for example via job rotation, transparent office architecture, and all kinds of group reflection and teamwork. Implementing teamwork does not conflict with the specific characteristics of PSFs. However, as indicated by the foregoing discussion, teamwork cannot be regarded as a panacea. Although teamwork is said to induce many positive effects, the literature reveals several related problems.

Overall, our discussion reveals that the literature provides few insights that are easily adopted by managers in PSFs to improve error management in their organizations. Suggestions such as creating psychological safety are vague, and other more specific recommendations appear questionable. Van Dyck et al. (2005: 1230), for instance, argue that some organizations "have cultivated certain systematic approaches to facilitating communication about errors. For example, an American consulting firm throws a party whenever projects fail, explicitly creating a situation in which communication about errors can naturally occur." One might wonder, however, whether such a party really does provide an open atmosphere within consulting companies, or whether it is more likely to discredit the project team by drawing attention to its entire membership as examples of incompetence.

Table 3.2 Effectiveness of instruments for consultants to learn from errors

Instruments that promote consultant learning from error	Mean	Standard deviation
Feedback from the project leader	6.11	1.07
Lessons learned	5.69	1.32
Supervision	5.52	1.48
Coaching	5.48	1.37
Mentoring	5.30	1.20
Peer counseling	5.00	1.36
360-degree feedback	4.80	1.50
Customer satisfaction survey	4.71	1.58
Training with case studies	4.54	1.67
Training by role reversal (consultant/client)	4.00	1.46
Communication training	3.70	1.58

Note: N (including "don't know") = 29; 7-point Likert scale: 1 = "no effectiveness at all" and 7 = "very effective."

In response to these deficits, we carried out an exploratory survey to reveal how management consultancies might promote a reflective method of dealing with errors. This survey took place between May and July 2008. Overall, 37 management consultants, employees of management consulting associations, and researchers in the field of management consulting were surveyed. According to the Delphi method (Häder, 2009), these experts answered questionnaires in three rounds (response rates were 92 percent, 84 percent, and 81 percent, respectively). In the second round, participants were asked to suggest management instruments that might improve consultants' reflective and self-critical handling of errors. The answers were clustered into 11 different groups; in the third round, the same respondents had to evaluate the effectiveness of these 11 instruments. As shown in Table 3.2, instruments that support conscious reflection about projects, such as feedback by the project leader (mean=6.11) and the formulation of "lessons learned" (mean=5.69), were regarded as the most effective, whereas instruments that were uncoupled from a concrete project, such as communication training (mean=3.70), were regarded as less effective. However, since these recommendations by our survey respondents have not been empirically analyzed, their contribution to more effective error management is questionable. Future research needs to specify precisely the potential form of these instruments, their external preconditions and mechanisms, and their transferability to all types of PSFs.

CONCLUSION

This chapter has provided an overview of the literature dealing with errors in organizations. A selection of implications on how to improve error management in organizations was presented and discussed. We identified and addressed the research gap regarding error management in PSFs. Furthermore, the opinions of experts in the field of management consulting were presented.

Our analysis shows that research has revealed a variety of mechanisms related to effective error management. However, most research has focused primarily on safety aspects within the healthcare sector and HROs. Research on PSFs has focused primarily on physical safety, while research on the financial impact of error management is sparse. Furthermore, the focus is often on isolated mechanisms of error management, such as the impact of a non-punishment culture on employees' willingness to share knowledge about their own errors, without analyzing the interactions with other error management mechanisms, for example the impact of a non-punishment culture on employees' motivation to prevent errors in the first place. As a consequence, this chapter reveals that many insights on how to improve error management turn out to be questionable if one considers their possible side effects. Accordingly, some applications appear incompatible with the work context in many PSFs. Psychological safety, for instance, is touted as an instrument to enhance employees' communication about their own errors, even though little is known about how psychological safety could be promoted in an environment where many highflying employees compete for limited opportunities for promotion.

Despite this criticism, our chapter extracts several insights about effective error management that may help managers to reflect on how to improve error management in their organizations. Several barriers to effective error management are discussed, and implications for how to overcome these barriers are provided. For instance, instruments that do not directly give employees the impression that they will be mistrusted by the organization or that increase social monitoring are regarded as worthwhile. Instruments mentioned that meet these requirements include job rotation, transparent office architecture, and all forms of group reflection. In particular, the positive effects of teamwork on error management were discussed. Finally, we refer to instruments such as "lessons learned" that were advocated and evaluated in a Delphi survey of 37 experts in the field of management consulting.

Even though this chapter presents a broad overview of the literature on error management in PSFs, we still find many arguments rather hypothetical. We therefore believe that there is a strong need for future empirical research along the lines suggested in this chapter.

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